

## CLAIMS

What is claimed is:

1. A pin for depositing a liquid on a substrate, the pin comprising:  
a printing tip at a first end thereof;  
a reservoir communicating with the printing tip; and  
a channel extending between the reservoir to the printing tip for delivering the liquid from the reservoir to the printing tip, wherein the channel has a tapered shape decreasing in width from the reservoir to the printing tip.
2. The pin according to claim 1, wherein the pin is microfabricated from a material selected from the group comprising semiconductors, polymers, ceramics, and non-ferric alloys.
3. The pin according to claim 1, wherein the pin has a constant width along a substantial portion of the pin's length and further comprising a head portion disposed at a second end thereof that is wider than the substantial portion of the pin's length.
4. The pin according to claim 1, wherein the printing tip has a non-flat substrate contacting surface.
5. The pin according to claim 1, wherein the pin has a conformal continuous coating of SiO<sub>2</sub>.
6. The pin according to claim 1, wherein the reservoir and printing tip are dimensioned to enable the pin to deposit a predetermined volume of the liquid on a substrate when the pin contacts the substrate.
7. The pin according to claim 6, wherein the predetermined volume comprises between about 10<sup>-4</sup> pL to about 0.1 mL.
8. The pin according to claim 6, wherein the predetermined volume of the liquid deposited on the substrate forms a spot having an area of about 10<sup>-6</sup> μm<sup>2</sup> to about 10 mm<sup>2</sup>.

9. The pin according to claim 1, wherein the pin has an external wall and grooves provided on the external wall leading to the channel for directing any excess liquid wetting to the external wall to the channels.
10. A pin for depositing a liquid on a substrate, the pin comprising:  
a printing tip at a first end thereof;  
a reservoir communicating with the printing tip, the pin having a thinned printing tip portion and a non-thinned remainder portion, including the reservoir, that is thicker than the thinned printing tip portion;  
a stepped portion between the thinned printing tip and the reservoir formed by the change in the thickness between the thinned printing tip and the non-thinned remainder portion; and  
a channel extending between the reservoir to the printing tip for delivering the liquid from the reservoir to the printing tip.
11. The pin according to claim 10, wherein the step has a curved outline.
12. The pin according to claim 11, wherein the curved outline approximates a section of an ellipse.
13. The pin according to claim 11, wherein the curved outline is a semi-circle.
14. The pin according to claim 10, wherein the channel has a tapered shape decreasing in width from the reservoir to the printing tip.

15. The pin according to claim 10, wherein the reservoir and printing tip are dimensioned to enable the pin to deposit a predetermined volume of the liquid on a substrate when the pin contacts the substrate.
16. The pin according to claim 15, wherein the predetermined volume comprises between about  $10^{-4}$  pL to about 0.1 mL.
17. The pin according to claim 16, wherein the predetermined volume of the liquid deposited on the substrate forms a spot having an area of about  $10^{-6}$   $\mu\text{m}^2$  to about 10  $\text{mm}^2$ .
18. A microcontact printing pin holder for use in producing a microarray, the holder comprising:
- a first planar member;
  - a first aperture extending through the planar member for receiving a pin that deposits a predetermined volume of a liquid on a substrate to produce the microarray; and
  - an elastomeric member provided at a distance above the first planar member, wherein the holder is microfabricated from a material selected from the group consisting of semiconductors, polymers, ceramics, and non-ferric alloys.
19. The holder according to claim 18, further comprising a second planar member having a second aperture extending therethrough for receiving a bottom portion of the pin, the second planar member disposed under the first planar member such that the apertures are in axial alignment with one another.
20. The holder according to claim 18, wherein the aperture in the first planar member comprises an array of apertures of about 32 apertures to up to about 100,000 apertures.

21. The holder according to claim 18, wherein the aperture in the first planar member comprises an array of apertures having an aperture density of about 1 aperture per 10 mm<sup>2</sup> to about 10<sup>6</sup> apertures per mm<sup>2</sup>, the aperture density providing a maximum pin density of about 1 pin per 10 mm<sup>2</sup> to about 10<sup>6</sup> pins per mm<sup>2</sup>.

22. A method of making a pin for depositing a liquid on a substrate, the method comprising:

patterning an outline of a bottom portion of the pin on a first side of a silicon wafer by deep reactive ion etch, the outline including a printing tip of the pin;

thinning the printing tip of the pin from the second side of the silicon wafer by deep reactive ion etch.